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Oceans and the law of the sea: sustainable fisheries, including through the 1995 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, and related instruments

Actions taken by States and regional fisheries management organizations and arrangements in response to paragraphs 113, 117 and 119 to 124 of General Assembly resolution 64/72 and paragraphs 121, 126, 129, 130 and 132 to 134 of General Assembly resolution 66/68 on sustainable fisheries, addressing the impacts of bottom fishing on vulnerable marine ecosystems and the long-term sustainability of deep-sea fish stocks

Report of the Secretary-General

Summary

The present report has been prepared pursuant to paragraph 164 of General Assembly resolution 69/109, in which the Assembly requested the Secretary-General, in cooperation with the Food and Agriculture Organization of the United Nations, to report to the General Assembly at its seventy-first session on the actions taken by States and regional fisheries management organizations and arrangements in response to paragraphs 113, 117 and 119 to 124 of resolution 64/72 and paragraphs 121, 126, 129, 130 and 132 to 134 of resolution 66/68, in order to facilitate the further review of the actions taken referred to in paragraph 162 of resolution 69/109.

The report is a follow-up to earlier reports prepared by the Secretary-General (A/61/154, A/64/305 and A/66/307). It should also be read in conjunction with earlier interim reports of the Secretary-General on the measures taken by States and regional fisheries management organizations and arrangements to implement resolution 61/105 (A/62/260, paras. 60-96, and A/63/128, paras. 63-78).

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Abbreviations

CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
CM	Conservation measure
CMM	Conservation and management measure
FAO	Food and Agriculture Organization of the United Nations
GFCM	General Fisheries Commission for the Mediterranean
ICES	International Council for the Exploration of the Sea
NAFO	Northwest Atlantic Fisheries Organization
NEAFC	North East Atlantic Fisheries Commission
NPFC	North Pacific Fisheries Commission
RFMO	Regional fisheries management organization
RFMO/As	Regional fisheries management organizations and arrangements
SEAFO	South East Atlantic Fisheries Organization
SIOFA	Southern Indian Ocean Fisheries Agreement
SPRFMO	South Pacific Regional Fisheries Management Organisation
UNEP	United Nations Environment Programme
VMEs	Vulnerable marine ecosystems

I. Introduction

1. The first global integrated marine assessment or first World Ocean Assessment[1] notes that, although no global assessment has been carried out on the extent of benthic impacts, the documented widespread extent of deep-water trawl fisheries in different regions and maritime zones has led to pervasive concern for the conservation of fragile benthic habitats. On seamounts where trawling has been discontinued, little regeneration is observed even after 5 to 10 years and recovery may require centuries to millennia.[2] That highlights the need for continued action to protect vulnerable marine ecosystems (VMEs).

2. Within the framework of the United Nations Convention on the Law of the Sea and the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (United Nations Fish Stocks Agreement), a number of actions have been taken by States and regional fisheries management organizations and arrangements (RFMO/As), inter alia, to address the impacts of bottom fishing on VMEs and the long-term sustainability of deep-sea fish stocks.

3. The continuous need to achieve sustainable fisheries and protect and manage marine ecosystems has also been underlined in a number of important outcomes in recent years, including in the outcome document of the United Nations Conference on Sustainable Development, "The future we want",[3] the 2030 Agenda for Sustainable Development,[4] including Sustainable Development Goal 14, and the recommendations of the resumed Review Conference on the United Nations Fish Stocks Agreement (see A/CONF.210/2006/15, annex, A/CONF.210/2010/7, annex, and A/CONF.210/2016/5 (forthcoming)). Also of relevance are decisions of the parties to the Convention on Biological Diversity.[5] Many of those outcomes include specific commitments by States to protect VMEs from destructive fishing practices and ensure the long-term sustainability of deep-sea fish stocks.

4. The General Assembly considered the impacts of bottom fishing on VMEs and the long-term sustainability of deep-sea fish stocks and called on States and RFMO/As to take a number of actions in that regard in 2006.[6] Since then, it has conducted reviews of actions taken by States and RFMO/As in response to its relevant resolutions on sustainable fisheries in 2009 and 2011.

5. In resolution 69/109, the General Assembly recalled its decision in paragraph 137 of resolution 66/68 to conduct a further review of the actions taken by States and RFMO/As in response to paragraphs 113, 117 and 119 to 124 of resolution 64/72 and paragraphs 121, 126, 129, 130 and 132 to 134 of resolution 66/68, with a view to ensuring effective implementation of the measures therein and to make further recommendations, where necessary. It recognized the value of preceding

[1] The General Assembly welcomed the assessment and approved its summary (A/70/112) in resolution 70/235. For the complete text of the assessment, see www.un.org/depts/los/global_reporting/WOA_RegProcess.htm.

[2] See World Ocean Assessment I, chap. 51.

[3] General Assembly resolution 66/288, annex.

[4] General Assembly resolution 70/1.

[5] See decisions IX/20 and X/2.

[6] See General Assembly resolution 61/105.

such a review with a two-day workshop, as in 2011, and decided to conduct such a review in 2016. In resolution 70/75 of 8 December 2015, the Assembly requested the Secretary-General to convene the two-day workshop on 1 and 2 August 2016 in order to discuss implementation of the above-mentioned paragraphs of resolutions 64/72 and 66/68.

6. Following the adoption of resolution 69/109, requesting the Secretary-General to report to the General Assembly at its seventy-first session, the Secretary-General requested States and regional economic integration organizations and RFMO/As to submit detailed information. The Food and Agriculture Organization of the United Nations (FAO) was also requested to provide information.

7. In response, submissions were received from 11 States (Australia, Bulgaria, Canada, Chile, Iceland, Iraq, New Zealand, Norway, Oman, Philippines and the United States of America), the European Union, FAO[7] and 8 RFMO/As.[8] The present report is based on the information provided and information contained in the responses to the request circulated in connection with the preparation of the report of the Secretary-General to the resumed Review Conference on the United Nations Fish Stocks Agreement (A/CONF.210/2016/1). The Secretary-General wishes to express his appreciation for the submissions.

II. Overview of the impacts of bottom fisheries on vulnerable marine ecosystems and the long-term sustainability of deep-sea fish stocks

8. The present section provides an update of the sections of previous reports of the Secretary-General on the actions taken to address the impacts of bottom fishing on VMEs and the long-term sustainability of deep-sea fish stocks. It should also be read in conjunction with the World Ocean Assessment, which also provides detailed information on deep-sea ecosystems, including specific habitats that can constitute VMEs, such as cold-water corals, hydrothermal vents and cold seeps, as well as on marine biological diversity and biological communities on seamounts and other submarine features potentially threatened by disturbance.[9]

A. Vulnerable marine ecosystems: an updated review

9. Previous reports of the Secretary-General have detailed the scientific advances which have been made in the understanding of habitats that may contain VMEs, including seamounts, hydrothermal vents, cold-water coral habitats and sponge

[7] The contribution of FAO is summarized in section IV below.

[8] CCAMLR, NAFO, NEAFC, NPFC and SEAFO. The International Commission for the Conservation of Atlantic Tunas, the North Atlantic Salmon Conservation Organization and the North Pacific Anadromous Fish Commission reported that they did not regulate bottom fisheries and/or did not have the mandate to do so. In addition, reference information was provided informally by the General Fisheries Commission for the Mediterranean (GFCM).

[9] See in particular, chapters 36F, 42, 45 and 51.

grounds.[10] The following section provides an updated review of those habitats, as well as additional information regarding other potential VMEs.[11]

1. Seamounts[2]

10. Over the last five years, there has been progress in understanding how seamount ecosystems are structured and function. While some seamounts do not contain VMEs, the expansion of seamount exploration has identified VMEs in new regions, as well as completely novel VMEs, such as the crinoid aggregations on the Admiralty Seamount.[12]

11. Past studies suggesting that seamount communities comprise a high proportion of endemic species remain largely unsupported (see A/66/307, para. 9). However, exploration of seamounts in more remote areas, such as the Southern Ocean and South-West Indian Ocean, have revealed novel communities or species.[13,14,15] The high variability of seamount communities across regions, within regions and even between adjacent seamounts presents a significant management challenge for deep-sea fisheries.[16]

2. Canyons

12. Submarine canyons are incisions into the continental shelf and slope and act as conduits for sediment and other materials from continents into the deep-sea. Canyons can be localities of enhanced biomass and a diversity of benthic and pelagic organisms, including aggregations of large megafauna, such as cetaceans,[17]

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[10] As previously reported, the vulnerability of an ecosystem is related to the likelihood that one or more components (i.e., population, community or habitat) will experience substantial alteration owing to short-term or chronic disturbance and the likelihood that it will recover, and in what time frame. The most vulnerable ecosystems are those that are both easily disturbed and very slow to recover, or may never recover.

[11] Due to the scarcity of data regarding VMEs on the high seas, this section also extrapolates from scientific research conducted in areas within national jurisdiction.

[12] See David A. Bowden and others, "A lost world? Archaic crinoid-dominated assemblages on an Antarctic seamount", *Deep-Sea Research Part II: Topical Studies in Oceanography*, vol. 58, Nos. 1-2 (January 2011).

[13] See Rhian G. Waller, Kathryn M. Scanlon and Laura Robinson, "Cold-water coral distributions in the Drake Passage area from towed camera observations — initial interpretations", *PLOS ONE*, vol. 6, No. 1 (January 2011).

[14] See Joana Xavier, Inês Tojeira and Rob van Soest, "On a hexactinellid sponge aggregation at the Great Meteor seamount (North-east Atlantic)", *Journal of the Marine Biological Association of the United Kingdom*, vol. 95, No. 7 (July 2015).

[15] See Jon Thomassen Hestetun, Hans Tore Rapp and Joana Xavier, "Carnivorous sponges (Porifera, Cladorhizidae) from the Southwest Indian Ocean Ridge seamounts", *Deep-Sea Research Part II: Topical Studies in Oceanography* (March 2016).

[16] Thomas A. Schlacher and others, "Seamount benthos in a cobalt-rich crust region of the central Pacific: conservation challenges for future seabed mining", *Diversity and Distributions*, vol. 20, No. 5 (May 2014).

[17] Fabio C. De Leo and others, "Submarine canyons: hotspots of benthic biomass and productivity in the deep sea", *Proceedings of the Royal Society of London B: Biological Sciences*, vol. 277, No. 1695 (September 2010).

and VMEs, such as cold-water coral communities.[18,19,20,21,22,23,24] Entire canyon systems may be regarded as VMEs and several have been protected from fishing within areas under national jurisdiction.

3. Chemosynthetic communities[25]

13. Several island-like habitats in the deep-sea host biological communities that are based largely on chemosynthetic primary production, including hydrothermal vents and cold seeps.

14. Hydrothermal vents generally occur below the depths of deep-sea fishing in extremely rugged terrain (see A/64/305, paras. 18-20, and A/66/307, paras. 11 and 12). The use of multibeam sonar to map mid-ocean ridges and deep-submergence technologies, such as remotely operated vehicles, has led to increased understanding of the distribution of hydrothermal vents.

15. New vent observations, such as those at polar latitudes, have resulted in the discovery of many new species of vent-endemic fauna and an improved understanding of the regional organization of vent fauna.[26] The connectivity of populations is an important consideration in assessing the risks from human activities to vent ecosystems.

16. There is evidence that seeps within exclusive economic zones have been damaged by fishing (for example, Hikurangi Margin in New Zealand[27] and Hecate Strait in Canada[28]) (see also A/66/307, para. 13). Although seeps occur mainly along continental margins within those zones, they are also found in the high seas. At present, there is no understanding of the capacity of such ecosystems to recover from bottom-fishing impacts.

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[18] Lies De Mol and others, "Cold-water coral habitats in the Penmarc'h and Guilvinec Canyons (Bay of Biscay): deep-water versus shallow-water settings", *Marine Geology*, vol. 282, Nos. 1-2 (March 2011).

[19] Veerle A. I. Huvenne and others, "A picture on the wall: innovative mapping reveals cold-water coral refuge in submarine canyon", *PLOS ONE*, vol. 6, No. 12 (December 2011).

[20] Robert J. Miller and others, "Structure-forming corals and sponges and their use as fish habitat in Bering Sea submarine canyons", *PLOS ONE*, vol. 7, No. 3 (March 2012).

[21] A. Gori and others, "Bathymetrical distribution and size structure of cold-water coral populations in the Cap de Creus and Lacaze-Duthiers canyons (northwestern Mediterranean)", *Biogeosciences*, vol. 10, No. 3 (March 2013).

[22] Kirsty J. Morris and others, "Distribution of cold-water corals in the Whittard Canyon, NE Atlantic Ocean", *Deep-Sea Research Part II: Topical Studies in Oceanography*, vol. 92 (August 2013).

[23] Sandra Brooke and Steve W. Ross, "First observations of the cold-water coral *Lophelia pertusa* in mid-Atlantic canyons of the United States", *Deep-Sea Research Part II: Topical Studies in Oceanography*, vol. 104 (June 2014).

[24] Andrea M. Quattrini and others, "Exploration of the canyon-incised continental margin of the northeastern United States reveals dynamic habitats and diverse communities", *PLOS ONE*, vol. 10, No. 10 (October 2015).

[25] See also World Ocean Assessment I, chap. 45.

[26] Alex D. Rogers and others, "The discovery of new deep-sea hydrothermal vent communities in the Southern Ocean and implications for biogeography", *PLOS Biology*, vol. 10, No. 1 (January 2012).

[27] Amy R. Baco and others, "Initial characterization of cold seep faunal communities on the New Zealand Hikurangi margin", *Marine Geology*, vol. 272, Nos. 1-4 (July 2010).

[28] J. Vaughn Barrie, Sarah Cook and Kim W. Conway, "Cold seeps and benthic habitat on the Pacific margin of Canada", *Continental Shelf Research*, vol. 31, No. 2 (2011).

4. Cold-water coral ecosystems[29]

17. The last five years have seen a leap forward in understanding the distribution of cold-water coral reefs, with new discoveries in many regions of the ocean, including along the continental margin of eastern South America.[30] Technological developments have been critical for the location of new cold-water coral reefs, including the use of high-resolution multibeam bathymetry, remotely operated vehicles and towed cameras.[19] In the absence of observational data on the presence of VMEs, habitat suitability modelling is being used as a guide to where they may occur[31] and can now be used in analysis of the risk of encounters of deep-sea bottom fisheries with VMEs.[32]

18. Cold-water coral reefs in some areas are already under threat from a range of human activities, including fisheries and marine debris accumulation, including fishing gear and large pieces of plastic debris.[33]

19. Coral carbonate mounds (see A/61/154, para. 17, and A/64/305, para. 26) are often associated with VMEs, including cold-water coral reefs and coral garden habitat.[34,35]

20. Coral gardens are ecologically important because of their association with high biological diversity. Associates may occur within the coral garden habitat or be directly associated with the corals.[20,36,37,38,39,40] Coral gardens can form an essential

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[29] See also A/64/305, paras. 21-25; A/66/307, paras. 14-18 and World Ocean Assessment I, chap. 42.

[30] Araceli Muñoz and others, "Sediment drifts and cold-water coral reefs in the Patagonian upper and middle continental slope", *Marine and Petroleum Geology*, vol. 36, No. 1 (September 2012).

[31] Martin Cryer, "Progress on predicting the distribution of vulnerable marine ecosystems and options for designing spatial management areas for bottom fisheries within the South Pacific Regional Fisheries Management Convention Area", paper prepared for the third meeting of the Scientific Committee of the South Pacific Regional Fisheries Management Organization, Vanuatu, 28 September-3 October 2015.

[32] Alexander D. T. Vierod, John M. Guinotte and Andrew J. Davies, "Predicting the distribution of vulnerable marine ecosystems in the deep sea using presence-background models", *Deep-Sea Research Part II: Topical Studies in Oceanography*, vol. 99 (January 2014).

[33] Alessandra Savini and others, "Mapping cold-water coral habitats at different scales within the northern Ionian Sea (central Mediterranean): an assessment of coral coverage and associated vulnerability, *PLOS ONE*. vol. 9, No. 1 (January 2014).

[34] J. Murray Roberts and others, "Cold-water coral reef frameworks, megafaunal communities and evidence for coral carbonate mounds on the Hatton Bank, north east Atlantic", *Facies*, vol. 54, No. 3 (August 2008).

[35] Christian Mohn and others, "Linking benthic hydrodynamics and cold-water coral occurrences: a high-resolution model study at three cold-water coral provinces in the NE Atlantic", *Progress in Oceanography*, vol. 122 (March 2014).

[36] Peter J. Auster and others, "Octocoral gardens in the Gulf of Maine (NW Atlantic)", *Biodiversity*, vol. 14, No. 4 (October 2013).

[37] Susana Carvalho and others, "Biodiversity patterns of epifaunal assemblages associated with the gorgonians *Eunicella gazella* and *Leptogorgia lusitanica* in response to host, space and time", *Journal of Sea Research*, vol. 85 (January 2014).

[38] Marzia Bo and others, "Persistence of pristine deep-sea coral gardens in the Mediterranean Sea (SW Sardinia)", *PLOS ONE*, vol. 10, No. 3 (March 2015).

[39] Robert P. Stone, Michele M. Masuda and John F. Karinen, "Assessing the ecological importance of red tree coral thickets in the eastern Gulf of Alaska", *ICES Journal of Marine Science*, vol. 72, No. 3 (November 2014).

[40] M. Ingrassia and others, "Black coral (Anthozoa, Antipatharia) forest near the western Pontine Islands (Tyrrhenian Sea)", *Marine Biodiversity*, vol. 46, No. 1 (March 2016).

fish habitat for commercially important fish (e.g. Alaska[39] and Azores[41]). Functional relationships between coral gardens and commercial fish have been identified, such as observations of larvae sheltering in coral habitat or eggs being attached to corals.[38,42]

21. Coral gardens are damaged by deep-sea bottom fishing[43,44,45] and heavily fished areas may show evidence of significant reduction in populations.[46] Because of the high longevity (up to >4,000 years)[47] of some species of corals, recovery potential is limited. Lost fishing gear has also been observed on coral garden habitats, causing prolonged impacts associated with entanglement and mechanical damage.[44,45,48]

5. Sponges[49]

22. The distribution and taxonomy of sponges is poorly known and discoveries of new species and new sponge habitats continue. Sponges are fragile and are therefore vulnerable to damage from bottom-contact fishing.[50,51,52] Some sponges, such as glass sponges, are highly vulnerable, not just to bottom trawling but also to longlining or other forms of line fishing, which may cut through the sponges and destroy them.[52,53] They are also slow-growing and their capacity to recover from

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[41] Christopher K. Pham and others, "The importance of deep-sea vulnerable marine ecosystems for demersal fish in the Azores", *Deep-Sea Research Part I: Oceanographic Research Papers*, vol. 96 (February 2015).

[42] Sandrine Baillon and others, "Deep cold-water corals as nurseries for fish larvae", *Frontiers in Ecology and the Environment*, vol. 10, No. 7 (September 2012).

[43] Evan N. Edinger and Owen A. Sherwood, "Applied taphonomy of gorgonian and antipatharian corals in Atlantic Canada: experimental decay rates, field observations, and implications for assessing fisheries damage to deep-sea coral habitats", *Neues Jahrbuch für Geologie und Paläontologie — Abhandlungen*, vol. 265, No. 2 (August 2012).

[44] Marzia Bo and others, "Deep coral oases in the South Tyrrhenian Sea", *PLOS ONE*, vol. 7, No. 11 (November 2012).

[45] Marzia Bo and others, "Fishing impact on deep Mediterranean rocky habitats as revealed by ROV investigation", *Biological Conservation*, vol. 171 (March 2014).

[46] F. J. Murillo and others, "Distribution of deep-water corals of the Flemish Cap, Flemish Pass, and the Grand Banks of Newfoundland (Northwest Atlantic Ocean): interaction with fishing activities", *ICES Journal of Marine Science*, vol. 73, No. 7 (June 2010).

[47] E. Brendan Roark and others, "Extreme longevity in proteinaceous deep-sea corals", *Proceedings of the National Academy of Sciences of the United States of America*, vol. 106, No. 13 (March 2009).

[48] Christopher K. Pham and others, "Abundance of litter on Condor seamount (Azores, Portugal, Northeast Atlantic)", *Deep-Sea Research Part II: Topical Studies in Oceanography*, vol. 98, part A (December 2013).

[49] See also A/64/305, paras. 27 and 28.

[50] Mariana M. Hogg and others, *Deep-sea Sponge Grounds: Reservoirs of Biodiversity*, UNEP-WCMC Biodiversity Series No. 32 (UNEP-World Conservation Monitoring Centre, Cambridge, United Kingdom, 2010).

[51] A. B. Klitgaard and O. S. Tendal, "Distribution and species composition of mass occurrences of large-sized sponges in the northeast Atlantic", *Progress in Oceanography*, vol. 61, No. 1 (April 2004).

[52] Manuel Maldonado and others, "Sponge grounds as key marine habitats: a synthetic review of types, structure, functional roles, and conservation concerns", in *Marine Animal Forests: The Ecology of Benthic Biodiversity Hotspots*, Sergio Rossi and others, eds. (Switzerland, Springer International Publishing, 2016).

[53] Manuel Maldonado and others, "Aggregated clumps of lithistid sponges: a singular, reef-like bathyal habitat with relevant paleontological connections", *PLOS ONE*, vol. 10, No. 5 (May 2015).

fishing or other impacts is limited.[50] Habitat-forming sponges are therefore regarded as potential VMEs.

6. Other vulnerable marine ecosystems

23. Other organisms are associated with VMEs or form VMEs, either by themselves or associated with other habitat-forming taxa.

24. Xenophyophores are giant protozoans that accrete inorganic material to form a complex test on the surface of the seabed. They are extremely fragile and easily destroyed by bottom-fishing gear.[54] Although they can grow in rapid bursts,[55] it is unclear whether they rapidly recover. Syringamminidae are listed as an indicator species for the mud- and sand-emergent fauna VME.[56]

25. Both stalked and unstalked crinoids can form aggregations,[12,57] and may be used as habitat by small fish and other invertebrates.[57] These animals are extremely fragile and are long-lived (>20 years) and the habitats they form are therefore classified as VMEs by at least one RFMO.[57] Crinoid VMEs have been identified in the areas covered by the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) and the Northwest Atlantic Fisheries Organization (NAFO).

26. Habitat-forming bryozoans are heavily-calcified species which extend for 5 cm or more in three dimensions. They host a wide range of other invertebrate species and the diversity of associates at local to regional scales can reach hundreds of species. In some cases, habitat-forming bryozoans can act as habitat for juvenile fish. Bottom fishing is a significant threat to them.[58]

27. Large sea squirts can occur in groups where they can form habitat for other species.[58] Although ascidians can grow relatively quickly[59] there is evidence that populations can decline as a result of fishing impacts (for example, in the Bay of Fundy, Canada).[60]

28. Tube-dwelling anemones of the order ceriantharia occur in sediments and can form high-density aggregations in the deep-sea.[61] Cerianthid anemones are known to

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[54] International Council for the Exploration of the Sea, "Report of the joint ICES/NAFO Working Group on deep-water ecology", 15-19 February 2016, Copenhagen.

[55] Andrew J. Gooday, B. J. Bett and D. N. Pratt, "Direct observation of episodic growth in an abyssal xenophyophore (Protista)", *Deep-Sea Research Part I: Oceanographic Research Papers*, vol. 40, Nos. 11/12 (November 1993).

[56] See North-East Atlantic Fisheries Commission, recommendation 19:2014, available from www.neafc.org/system/files/Rec19-Protection-of-VMEs_0.pdf.

[57] Francisco Javier Murillo and others, "New VME indicator species (excluding corals and sponges) and some potential VME elements of the NAFO Regulatory Area", NAFO SCR Doc. 11/73, December 2011, available from www.archive.nafo.int/open/sc/2011/scr11-073.pdf.

[58] A. C. L. Wood and others, "Complex habitat generated by marine bryozoans: a review of its distribution, structure, diversity, threats and conservation", *Aquatic Conservation: Marine and Freshwater Ecosystems*, vol. 22, No. 4 (June 2012).

[59] S. J. Parker and D. A. Bowden, "Identifying taxonomic groups vulnerable to bottom longline fishing gear in the Ross Sea region", *CCAMLR Science*, vol. 17 (2010).

[60] Ellen L. Kenchington and others, "Multi-decadal changes in the megabenthos of the Bay of Fundy: the effects of fishing", *Journal of Sea Research*, vol. 58, No. 3 (April 2007).

[61] S. D. Fuller and others, "Vulnerable marine ecosystems dominated by deep-water corals and sponges in the NAFO Convention Area", NAFO SCR doc. 08/22, available from archive.nafo.int/open/sc/2008/scr08-022.pdf.

be damaged by bottom-contact fishing and given their relatively high longevity (11-20 years) they may be classified as VMEs.[61]

29. Serpulids are polychaete worms that secrete calcareous tubes that can form habitat when they occur in tangled masses, with or without association to coral frameworks. The impacts of bottom trawl fishing on these types of habitats are likely to be extremely large because of their fragility and thus they are classified as VMEs.[62]

30. High-density aggregations of large erect hydroids, brittlestars (Ophiuroidea), barnacles, bivalve molluscs or brachiopods can form habitat on the seabed and are fragile organisms vulnerable to impacts from bottom fishing.[57,63,64] In addition, deep-sea urchins, especially cidaroidea (pencil urchins), can occur in relatively high numbers in the deep-sea and can provide habitat for other species.[65,66]

B. Deep-sea fish stocks

31. Previous reports of the Secretary-General have provided information on the characteristics of deep-sea fish stocks, including their vulnerability to overfishing (see, for example, A/66/307, paras. 22-27). There is no universally accepted definition of what constitutes a deep-sea commercial species[67] although generally they are identified as occurring deeper than 200-500 metres.[68] There are significant correlations between depth and general life-history traits. For example, rates of population increase drop with increasing depth and maximum age and age at maturity increase with depth.[69,70,71] The proportion of species with a higher vulnerability to overfishing is therefore positively correlated with depth.[69,72,73]

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[62] Ana Ramos and Guillermo San Martín, "On the finding of a mass-occurrence of *Serpula narconensis* Baird, 1885 (Polychaeta, Serpulidae) in South Georgia (Antarctica)", *Polar Biology*, vol. 22, No. 6 (November 1999).

[63] CCAMLR VME Taxa Identification Guide 2009, (Hobart, Tasmania, Australia, 2009), available from www.ccamlr.org/en/system/files/VME-guide.pdf.

[64] Mark P. Johnson and others, "A vertical wall dominated by *Acesta excavata* and *Neopycnodonte zibrowii*, part of an undersampled group of deep-sea habitats", *PLOS ONE*, vol. 8, No. 11 (November 2013).

[65] Carlo Cerrano and others, "Epibiotic demosponges on the Antarctic scallop *Adamussium colbecki* (Smith, 1902) and the cidaroid urchins *Ctenocidaris perrieri* Koehler, 1912 in the nearshore habitats of the Victoria Land, Ross Sea, Antarctica", *Polar Biology*, vol. 32, No. 7 (July 2009).

[66] C. Hardy and others, "Ectosymbiosis associated with cidaroids (Echinodermata: Echinoidea) promotes benthic colonization of the seafloor in the Larsen Embayments, western Antarctica", *Deep-Sea Research Part II: Topical Studies in Oceanography*, vol. 58, Nos. 1-2 (January 2011).

[67] O. A. Bergstad, "North Atlantic demersal deep-water fish distribution and biology: present knowledge and challenges for the future", *Journal of Fish Biology*, vol. 83, No. 6 (December 2013).

[68] Malcolm R. Clark and others, "The impacts of deep-sea fisheries on benthic communities: a review", *ICES* Journal *of Marine Science*, vol. 73, suppl. 1 (January 2016).

[69] Colin A. Simpfendorfer and Peter M. Kyne, "Limited potential to recover from overfishing raises concerns for deep-sea sharks, rays and chimaeras", *Environmental Conservation*, vol. 36, No. 2 (June 2009)

[70] Jeffrey C. Drazen and Richard L. Haedrich, "A continuum of life histories in deep-sea demersal fishes", *Deep-Sea Research Part I: Oceanographic Research Papers*, vol. 61 (March 2012).

[71] Sebastian Villasante and others, "Sustainability of deep-sea fish species under the European Union Common Fisheries Policy", *Ocean and Coastal Management*, vol. 70 (December 2012).

[72] William W. L. Cheung and others, "Intrinsic vulnerability in the global fish catch", *Marine Ecology Progress Series*, vol. 333, Nos. 1-12 (March 2007).

32. Since 2011, there has been an increase in scientific knowledge regarding the characteristics and status of some deep-sea fish stocks.[74] However, the overall state of knowledge regarding deep-sea fish stocks remains limited (see A/CONF.210/2016/1, para. 26).

C. Impacts of bottom fishing on vulnerable marine ecosystems and deep-sea fish stocks

33. Modern large-scale bottom fisheries were fostered by technological developments and distant-water industrial fishing. Gillnets, longlines and both pelagic and bottom trawls have been the primary gears. Bottom trawls have had the greatest impact, affecting both targeted and non-targeted species, including associated benthic communities (see also para. 44 below). Those fisheries have occurred in all oceans except the Arctic, although an increasing number of restrictions on such fishing activities are being imposed[2] (see also section III below).

34. The following section updates the information in previous reports of the Secretary-General on the impacts of bottom-fishing activities on VMEs and deep-sea fish stocks (see A/61/154, paras. 24-56; A/64/305, paras. 38-43; and A/66/307, paras. 28-39).

1. Vulnerable marine ecosystems

35. The impacts of bottom trawling in the deep-sea may include the scraping and ploughing of the seabed, killing of non-target species, destruction of habitat, resuspension of sediments potentially smothering fauna and the dumping of processing wastes. Many of those impacts also occur in shallow waters, but the fragility of deep-sea ecosystems and the extreme longevity and slow growth rates of many deep-sea species means that recovery may be much slower in the deep-sea.[68] Observations of areas where fishing has ceased have shown no recovery of benthic VMEs (cold-water coral reef) in 5-10 years.[75,76] Modelling of the recovery of sponges and corals from trawling in Alaska at relatively shallow depths (down to 300m) has suggested the recovery of 80 per cent of biomass after several decades.[77]

36. The impacts of deep-sea trawling on soft substrata, such as sand or mud, have been less studied and publicized than on hard substrata, but can be significant. VME species, such as sponges and octocorals (e.g. sea pens), also occur on soft substrata

[73] Elliot A. Norse and others, "Sustainability of deep-sea fisheries", *Marine Policy*, vol. 36, No. 2 (March 2012).

[74] See, for example, Ross Shotton, *Global Review of Alfonsino (Beryx spp.), Their Fisheries, Biology and Management*, FAO Fisheries and Aquaculture Circular No. 1084 (Rome, FAO, 2016).

[75] F. Althaus and others, "Impacts of bottom trawling on deep-coral ecosystems of seamounts are long-lasting", *Marine Ecology Progress Series*, vol. 397 (December 2009).

[76] Alan Williams and others, "Seamount megabenthic assemblages fail to recover from trawling impacts", *Marine Ecology*, vol. 31, suppl. 1 (September 2010).

[77] Christopher N. Rooper and others, "Modelling the impacts of bottom trawling and the subsequent recovery rates of sponges and corals in the Aleutian Islands, Alaska", *Continental Shelf Research*, vol. 31, No 17 (November 2011).

and trawling has similar negative impacts on those organisms as in rocky habitats.[78] So large are the physical and biological effects of trawling on deep-sea sediments that they may impact biogeochemical cycling at the local to regional scale.[79]

37. In addition to deep-sea bottom trawling, bottom longlining is increasingly recognized as capable of damaging VMEs, particularly branching corals and sponges.[39,53,80,81,82,83] Damage to VME species occurs from the weights used to hold lines to the seabed, lateral movement of longline sets during retrieval, or as a result of currents at the seabed, and also through the hooking and entanglement of organisms.[39,80,82] While the level of impacts of individual longlines is small compared to bottom trawls, in the conditions of high fishing intensity, where VMEs are present, they may represent a threat.[39,80] Longlines can also be used in areas of complex rocky topography, where trawling is not possible.[80] These considerations may be particularly important where there is evidence of increased longline effort, for example, as a result of restrictions on other forms of fishing (e.g. gillnetting or bottom trawling).

38. The use of seabed imaging methods, such as towed cameras and remotely operated vehicles, indicates that high levels of lost fishing gear may also be found in VMEs. That is especially the case where such VMEs comprise or are located in complex seabed topography with hard substrata (e.g. seamounts or canyons).[20,33,39,40,44,45,53,84,85] Lost gear has the potential to ghost fish, to continue damaging VME species through entanglement and/or abrasion and poses a significant risk to further fishing operations and scientific research.

2. Deep-sea fish stocks

39. The scale of bottom fisheries and their impacts on deep-sea fish stocks have been detailed in previous reports of the Secretary-General (see, for example, A/66/307, paras. 33-39). Overexploitation of deep-sea fish species has resulted in the depletion of some stocks for which targeted fishing has, in some cases, been prohibited (for example, orange roughy in the North-East Atlantic).[86] Even where

[78] Lene Buhl-Mortensen and others, "Trawling disturbance on megabenthos and sediment in the Barents Sea: chronic effects on density, diversity, and composition", *ICES Journal of Marine Science*, vol. 73, suppl. 1 (November 2015).

[79] Jacobo Martín and others, "Commercial bottom trawling as a driver of sediment dynamics and deep seascape evolution in the Anthropocene", *Anthropocene*, vol. 7, (September 2014).

[80] P. Durán and others, "Effects of deep-sea bottom longlining on the Hatton Bank fish communities and benthic ecosystem, north-east Atlantic", *Journal of the Marine Biological Association of the United Kingdom*, vol. 91, No. 4 (December 2011).

[81] Michelle L. Taylor and others, "Using fisheries by-catch data to predict octocoral habitat suitability around South Georgia", *Journal of Biogeography*, vol. 40, No. 9 (September 2013).

[82] M-C. Fabri and others, "Megafauna of vulnerable marine ecosystems in French Mediterranean submarine canyons: spatial distribution and anthropogenic impacts", *Deep-Sea Research Part II: Topical Studies in Oceanography*, vol. 104 (June 2014).

[83] Christopher K. Pham and others, "Deep-water longline fishing has reduced impact on vulnerable marine ecosystems", *Nature Scientific Reports*, vol. 4 (April 2014).

[84] Lucy C. Woodall and others, "Deep-sea litter: a comparison of seamounts, banks and a ridge in the Atlantic and Indian Oceans reveals both environmental and anthropogenic factors impact accumulation and composition", *Frontiers in Marine Science*, vol. 2 (February 2015).

[85] Michela Angiolillo and others, "Distribution and assessment of marine debris in the deep Tyrrhenian Sea (NW Mediterranean Sea, Italy)", *Marine Pollution Bulletin*, vol. 92, Nos. 1-2 (January 2015).

[86] International Council for the Exploration of the Sea, "Report of the Working Group on biology and assessment of deep-sea fisheries resources", ICES Advisory Committee, 20-27 April 2016, Copenhagen.

total allowable catches have been set, actual catches have frequently exceeded them in some areas[72] and catch data can be poor, misreported or aggregated across species.

40. In addition to targeted species, populations of by-catch fish species have also been depleted by deep-sea fisheries.[87,88,89] Moreover, the impact of deep-sea fisheries may extend beyond the footprint where fishing occurs.[88,90]

41. For some deep-sea fish species, science-based management is enabling sustainable fishing of target species. However, independent surveys, an important tool for monitoring the abundance of target and non-target fish species, as well as broader aspects of the environment, are lacking for many regions.[67,91]

42. New methods are being developed for stock assessment of target and by-catch deep-sea fish where data is poor or is only available from the fish catches.[92] They may be useful for a broader range of deep-sea fisheries especially where economic considerations mean that larger assessment programmes are unlikely to be viable.

43. The continued targeting of species known to have a high vulnerability to overfishing[69] and in geographic areas where scientific information is scant remains a cause for concern (for example, the southern Indian Ocean),[93] as the recovery of many overexploited stocks/populations of target and by-catch species has been slow.[89]

3. Mitigation efforts

44. Improved impact assessments and area closures have had some success in reducing the impacts of bottom fishing on VMEs and deep-sea fish stocks. Technical modifications of fishing gear or changes in fishing practice have also been studied as a way to reduce impacts, but with limited success.[68]

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[87] Jennifer A. Devine and others, "Deep-sea fishes qualify as endangered", *Nature*, vol. 439, No. 29 (January 2006).

[88] Imants G. Priede and others, "A review of the spatial extent of fishery effects and species vulnerability of the deep-sea demersal fish assemblage of the Porcupine Seabight, Northeast Atlantic Ocean (ICES Subarea VII)", *ICES Journal of Marine Science*, vol. 68, No. 2 (June 2010).

[89] Francis Neat and others, "The diversity, distribution and status of deep-water elasmobranchs in the Rockall Trough, north-east Atlantic Ocean", *Journal of Fish Biology*, vol. 87, No. 6 (December 2015).

[90] D. M. Bailey and others, "Long-term changes in deep-water fish populations in the northeast Atlantic: a deeper reaching effect of fisheries?", *Proceedings of the Royal Society B: Biological Sciences*, vol. 276, No. 1664 (June 2009).

[91] Philip A. Large and others, "Strengths and weaknesses of the management and monitoring of deep-water stocks, fisheries, and ecosystems in various areas of the world: a roadmap toward sustainable deep-water fisheries in the northeast Atlantic?", *Reviews in Fisheries Science*, vol. 21, No. 2 (2013).

[92] Pascal Lorance, "Management and monitoring of deep-sea fisheries and stocks", *Aquatic Living Resources*, vol. 26, No. 4 (October-December 2013).

[93] L. J. López-Abellán and I. Figueiredo, Report of the European Union to the annual meeting of the Scientific Committee of the Southern Indian Ocean Fisheries Agreement (Fremantle, Australia, 20-24 March 2016).

45. For example, in some cases, a switch from bottom trawl to mid-water trawl may be feasible as a way to lessen impacts, but although bottom contact from mid-water trawls is of lower intensity, it could still result in damage to VMEs.[94] Spatial conservation measures, whether through closure of areas where VMEs are present or by limiting the depth of fishing, remain the most effective measures to conserve such ecosystems.

46. Implementation of encounter protocols presents a number of challenges.[95,96] Problems associated with their implementation include the absence of a rigorous process of VME identification; extremely high thresholds for VME indicator species not based on any form of scientific analysis, such as kernel density estimation,[97] and the specification that for corals the by-catch must be live.[98] Where "move-on" action is triggered, it is important that the move-on distance reflects the potential zone in which a VME may occur (e.g. anywhere along a trawl track or longline setting) and that the area is subject to rapid assessment and if necessary closure by the managing body.

III. Actions taken by States and regional fisheries management organizations and arrangements to address the impacts of bottom fisheries on vulnerable marine ecosystems and the long-term sustainability of deep-sea fish stocks

A. Actions taken by regional fisheries management organizations and arrangements with competence to regulate bottom fisheries[99]

47. The following section describes actions to give effect to the relevant paragraphs of General Assembly resolutions 64/72 and 66/68 and address the impacts of bottom fishing on VMEs and the long-term sustainability of deep-sea fish stocks, taken by RFMO/As with the competence to regulate bottom fisheries: CCAMLR, General Fisheries Commission for the Mediterranean (GFCM), NAFO, North East Atlantic Fisheries Commission (NEAFC), North Pacific Fisheries

[94] Geoff Tingley, "An assessment of the potential for near-seabed midwater trawling to contact the seabed and to impact benthic habitat and vulnerable marine ecosystems (VMEs)", Ministry for Primary Industries, New Zealand, technical paper No. 2014/30 (2014).

[95] Peter J. Auster and others, "Definition and detection of vulnerable marine ecosystems on the high seas: problems with the move-on rule", *ICES Journal of Marine Science*, vol. 68, No. 2 (April 2010).

[96] Alex D. Rogers and Matthew Gianni, "The Implementation of UNGA resolutions 61/105 and 64/72 in the management of deep-sea fisheries on the high seas", report prepared for the Deep-Sea Conservation Coalition (International Programme on the State of the Ocean, 2010).

[97] Ellen Kenchington and others, "Kernel density surface modelling as a means to identify significant concentrations of vulnerable marine ecosystem indicators", *PLOS ONE*, vol. 9, No. 10 (October 2014).

[98] As cold-water coral reefs often largely comprise dead coral framework with a relatively small portion made up of live framework-building coral, specification that coral by-catch must be live is therefore likely to result in VMEs not being identified through the encounter protocol.

[99] Information provided by the RFMO/As is supplemented by that provided by States and the European Union, as well as responses submitted by RFMO/As to the voluntary questionnaire for States and RFMO/As for the report of the Secretary-General to the resumed Review Conference on the United Nations Fish Stocks Agreement. Where such supplemental information is utilized, the source is indicated in the footnotes.

Commission (NPFC), South East Atlantic Fisheries Organization (SEAFO), Southern Indian Ocean Fisheries Agreement (SIOFA) and South Pacific Regional Fisheries Management Organisation (SPRFMO).

48. Among the three new RFMO/As competent to manage bottom fisheries in areas beyond national jurisdiction, SPRFMO has adopted conservation and management measures (CMMs) to address the call to action by the General Assembly, while SIOFA and NPFC still need to do so. States that have participated in the negotiations to establish those three RFMO/As have adopted and implemented interim measures.

49. Following the entry into force of the Convention on the Conservation and Management of High Seas Fishery Resources in the South Pacific Ocean in 2012, SPRFMO reported that CMM 2.03 was adopted in 2013 to implement the 2008 FAO International Guidelines for the Management of Deep-Sea Fisheries in the High Seas (the Guidelines)[100] and relevant General Assembly resolutions.[101] It was succeeded by an almost identical measure, CMM 4.03, in 2016, which limits vessels flying the flag of a SPRFMO member or a cooperating non-Contracting Party to fishing within a specified fishing footprint, and prohibits SPRFMO members and cooperating non-Contracting Parties from authorizing their flagged vessels to engage in any bottom fishing in the SPRFMO Convention Area, unless they have prepared a bottom-fishing impact assessment.[102] Furthermore, SPRFMO CMM 1.02 (2013) prohibits the use of all deepwater gillnets in the Convention Area.[103]

50. Having entered into force in 2012, SIOFA recently agreed on its rules of procedure and has yet to establish binding CMMs. Australia reported that it was preparing a CMM for the management of bottom fishing in the SIOFA Area, seeking to implement the relevant General Assembly resolutions, and further noted that it would be considered by the SIOFA Scientific Committee in March 2016 for proposal to the meeting of the parties to the Agreement in June 2016.

51. The Convention on the Conservation and Management of High Seas Fisheries Resources in the North Pacific Ocean, which established NPFC, entered into force in 2015. At the 13th meeting of the scientific working group in August 2015, NPFC reported that participants recognized the need to convert the VME and marine species interim and voluntary measures into formal NPFC measures in the light of the coming into force of the Convention. The working group recommended that NPFC, inter alia, approve continuation of all current interim measures as formal interim measures, continue all voluntary measures and direct the Scientific Committee to initiate the process for refinement of the formal NPFC interim and voluntary measures to bring them up to formal CMMs.

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[100] FAO, *Report of the Technical Consultation on International Guidelines for the Management of Deep-Sea Fisheries in the High Seas, Rome, 4-8 February and 25-29 August 2008*, FAO Fisheries and Aquaculture report No. 881, appendix F (Rome, 2008).

[101] SPRFMO response to the voluntary questionnaire for States and RFMO/As for the report of the Secretary-General to the resumed Review Conference on the United Nations Fish Stocks Agreement.

[102] Contribution of Australia.

[103] Contribution of New Zealand.

1. Identifying vulnerable marine ecosystems on the basis of marine scientific research and other sources of information (paragraph 119 (b) of resolution 64/72 and paragraphs 132 and 133 of resolution 66/68)

52. Several RFMOs reported having identified areas where VMEs occurred or were likely to occur, based on the results of marine scientific research and scientific and technical information obtained from other sources. In doing so, they carried out research programmes and/or elaborated on the definition of VMEs in the context of their regions.

53. CCAMLR reported that its description of VMEs in its CM 22-06 included the habitats and communities identified in paragraph 80 of resolution 61/105 and paragraph 113 of resolution 64/72 and sponge fields. CCAMLR maintained a registry of VMEs in the Convention Area,[104] which included their location and characteristics.[105]

54. NAFO reported that it had facilitated research on deep-sea species and ecosystems through the exchange of information and data in its scientific forums, coordination of funding of relevant research and the analysis of vessel monitoring system data by the secretariat. The NAFO NEREIDA project[106] represented a major multidisciplinary research effort on sensitive habitats and fishing activities in the north-west Atlantic and an in-depth analysis of the impacts of fishing on VMEs.[107]

55. With regard to the use of research results, NAFO has convened a series of scientific and fisheries management working groups since 2008 and convened a joint scientific-fisheries management group in 2014 and 2015.

56. NAFO has also made efforts to ensure that the measures taken to promote sustainable fisheries and the protection of ecosystems in the deep-sea were consistent with the Guidelines, including by reviewing species caught during research vessel surveys against the Guidelines for identifying VMEs and reassessing its bottom-fishing activities.[108]

57. In 2011, as a result of research vessel surveys in the NAFO Regulatory Area, three new groups (crinoids, erect bryozoans and large sea squirts) had emerged as potential indicators of VMEs, in addition to the coral and sponge taxa. Seamounts, canyon heads, spawning areas and knolls, listed as VME elements in the Guidelines, had also been identified. All of the new VME indicators and elements were mapped. The NAFO "Coral, sponge and other vulnerable marine ecosystem indicator identification guide" was published in 2015, to improve reporting related to the implementation of the ecosystem approach.

58. NEAFC reported that it had not conducted scientific work, but based its work on scientific advice from the International Council for the Exploration of the Sea (ICES), which undertook work on all the elements referred to in paragraph 133 of resolution 66/68. NEAFC and its Contracting Parties provided ICES with various data. On the basis of the best scientific information available, areas where VMEs occurred or were likely to occur were identified.

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[104] See www.ccamlr.org/en/document/data/ccamlr-vme-registry.
[105] Contribution of the United States.
[106] See www.nafo.int/science/nereida.html.
[107] Also reported by Canada and the European Union.
[108] Also reported by Canada.

59. SEAFO reported that a research cruise by the *RV Dr. Fridtjof Nansen* was conducted in 2015, to obtain more information on bathymetry, VME indicator organisms, fisheries resources and evidence of human footprint in the different study areas. The data collected during the research cruise indicated that corals in some knolls would be classified as coral gardens and/or reefs, and therefore as VMEs. The SEAFO definition of VMEs was derived from paragraphs 42 and 43 of the Guidelines. In 2014, SEAFO adopted guidelines for scientific research conducted in the SEAFO Convention Area, which differentiated exploratory fishing from scientific research.

60. SPRFMO CMM 2.03 set out rules for identifying, on the basis of the best available scientific information, areas where VMEs were known or were likely to occur in the Convention Area, mapping those sites and providing such data to the SPRFMO secretariat for circulation.[103] In SPRFMO, the initial work related to the identification of areas where VMEs might occur included an analysis of historical VME by-catch weights in bottom-trawl operations to develop a definition of what taxa constituted evidence of VMEs and to develop a move-on protocol, based on threshold by-catch weights, plus an index of biodiversity.[103] Research on deep-sea species, particularly orange roughy, was carried out under the auspices of the SPRFMO Scientific Committee workplan and research programme.[102]

2. Adopting conservation and management measures to protect vulnerable marine ecosystems or closing areas to bottom fishing until such measures are in place (paragraph 132 of resolution 66/68)

(a) Assessing the impacts of bottom fisheries on vulnerable marine ecosystems (paragraph 119 (a) of resolution 64/72; paragraphs 129 (a)-(c) of resolution 66/68)

61. Several RFMOs have maintained the possibility for bottom fisheries to take place in VMEs if they have been assessed as not having significant adverse impacts on VMEs. To that end, several RFMOs have established protocols for exploratory fisheries, which require those intending to conduct bottom fisheries to submit fisheries plans, preliminary assessments of impacts and, if significant adverse impacts are likely, mitigation measures. They have also provided for procedures for the examination and approval of proposals.

62. CCAMLR reported that CM 22-06 and CM 22-07 provided for an assessment process, undertaken by its Scientific Committee. It determined whether proposed bottom-fishing activities, taking into account, inter alia, the history of bottom fishing in the area proposed and a risk assessment, would contribute to significant adverse impacts on VMEs, and ensured that, if it was determined that those activities would make such contributions, they were managed to prevent such impacts or were not authorized to proceed. CM 22-06 includes a form for submitting preliminary assessments of the potential for proposed bottom-fishing activities to have significant adverse impacts on VMEs.

63. NEAFC reported that, since regular fisheries had been restricted to specific sub-areas where VMEs were unlikely to occur, any regular bottom fisheries that continued had been assessed as not being likely to have significant adverse impacts on VMEs.[109] It prohibited regular fishing with bottom gear beyond existing fishing areas. Exploratory fishing beyond those areas could only be authorized if the risk of

[109] NEAFC reported that paragraph 129 (a) of resolution 66/68 did not apply to it.

significant adverse impacts to VMEs was assessed to be minimal, after the proposing party had submitted a letter of intent and a pre-assessment with specified content. The Permanent Committee on Management and Science would assess the proposal and advise NEAFC whether it considered the activity to have significant adverse impacts on VMEs. The Committee had formulated procedures and standards for the consideration of such proposals. NEAFC also reported that the assessment called for in paragraph 83 (a) of resolution 61/105 had been conducted. In all three cases, where proposals had been made for exploratory bottom fisheries, the proposed activity was assessed as not having significant adverse impacts on VMEs. However, it had not allowed activities to commence, because the target species were a sedentary species subject to coastal State jurisdiction.

64. SEAFO reported that CM 30/15 addressed assessments associated with exploratory fisheries, requiring, inter alia, the gathering of relevant data, which should preferably include data from sea-bed mapping programmes and/or other data relevant to the preliminary assessment of the risk of significant adverse impacts on VMEs; a notice of intent to undertake exploratory bottom fishing; and a preliminary assessment of the known and anticipated impacts of the proposed bottom-fishing activity. The Scientific Committee would undertake an evaluation of the impact assessment and provide advice to the Commission as to whether the proposed activity would have significant adverse impacts on VMEs and, if so, whether mitigation measures would prevent such impacts. On that basis, the Commission would either give or withhold its approval. Following exploratory bottom fishing, the Commission would decide whether or not to authorize new bottom-fishing activities, based upon its results. Areas where such new bottom-fishing activities were authorized would be defined as "existing bottom-fishing areas". In such cases, SEAFO would take into account the guidance provided by FAO in the framework of the code of conduct for responsible fisheries and any other internationally agreed standards, as appropriate.

65. It was reported that, since 2011, CCAMLR had strengthened and streamlined procedures for carrying out assessments to take into account cumulative impacts, refined the data requirements for CCAMLR members to improve the effectiveness of assessments and management measures, and recommended a review to determine whether current management measures were sufficient.[103]

66. NAFO reported that it had adopted a cycle of advice, review and implementation of its management measures to ensure that the ecosystem approach was always considered when fisheries management decisions were taken. The NAFO road map for developing an ecosystem approach to fisheries served as a framework to assess and mitigate significant adverse impacts on any part of the ecosystem. In particular, since 2008, NAFO had established a process for reviewing its measures for the protection of VMEs, allowing refinement of its management measures on the basis of the most up-to-date scientific information. The ongoing review ensured that assessments were undertaken on a regular basis. Specifically, article 24 of its conservation and enforcement measures imposed the obligation on NAFO to review its VME measures before 2020.

67. NAFO was preparing for a reassessment of its bottom-fishing activities to be presented at its annual meeting in 2016. It would take the necessary actions to protect VMEs following the reassessment and conduct a reassessment of its bottom-fishing activities every five years thereafter.

68. NEAFC reported that ICES updated its scientific advice to NEAFC on the basis of any new information, or new assessment of existing information. NEAFC would then take action, including closing new areas to bottom fishing and adjusting the borders of already closed areas. Furthermore, time limits were in place on the NEAFC area closures to ensure that they were revisited and reviewed regularly. Assessments of the occurrence of VMEs and area closures based on them were therefore regularly updated.

69. SEAFO reported that review procedures were included in its measures and now also applied to existing bottom-fishing areas (CM 30/15). Currently, the closed areas were closed to all types of fishing that it managed. However, with its approval, research activities would be permitted within the closed areas and further information could lead to changes in the measures adopted, including closures.

70. SPRFMO requested its Scientific Committee to review and streamline the bottom-fishing impact assessment standard agreed by the Scientific Working Group in 2011, to take account of the latest scientific information available. The measure was scheduled for review in 2017, taking into account the latest advice of the Scientific Committee.[109]

(b) Closing areas containing marine ecosystems vulnerable to bottom fishing

71. Several RFMOs closed areas where VMEs occurred or were likely to occur. CCAMLR has implemented a set of regulations and guidelines to protect VMEs, particularly through CM 22-05 (2008) on restrictions on the use of bottom-trawling gear in high-seas areas of the Convention Area.[110] Since 2011, CCAMLR has closed further areas to bottom fishing based on the best scientific and technical information available.[103] CM 22-09, adopted in 2011, relates to the protection of registered VMEs within areas open to bottom fishing, in which bottom fishing was prohibited in the defined areas set out in its annex, except for scientific research activities agreed on by CCAMLR. It also adopted CM 22-07 (2013) on interim measures for bottom-fishing activities and CM 22-06 (2015) on bottom fishing in the Convention Area.[111]

72. GFCM reported that since 2006, it had declared seven fisheries restricted areas (including three in 2016). Furthermore, in 2013, the Commission had adopted resolution GFCM/37/2013/1 on area-based management of fisheries, including through the establishment of fisheries restricted areas in the GFCM Convention area and in coordination with the United Nations Environment Programme (UNEP) Mediterranean Action Plan initiatives on the establishment of specially protected areas of Mediterranean importance.[112] The Agreement for the Establishment of the General Fisheries Commission for the Mediterranean, as amended in 2014, provides for the establishment of fisheries restricted areas for the protection of VMEs.

73. NAFO reported that since 2011, it had continued to refine management measures to protect VMEs, including through closures of seamounts to bottom fishing at its annual meeting in 2015.[105] NAFO closed 380,000 km^2 to bottom

[110] Contribution of Norway.

[111] Ibid. There are currently no bottom trawl fisheries in the CCAMLR area, only longline fisheries, primarily for tooth fish, with bottom contact.

[112] Instruments available from www.fao.org/3/a-ax392e.pdf.

fishing on seamounts and in other areas where such species were known or predicted to form significant concentrations.

74. The NAFO Scientific Council had noted that management through the closing of areas with significant concentrations of VME indicator species was the most effective measure for protecting VMEs in the NAFO Regulatory Area and that the need to implement encounter protocols gradually became redundant as the locations of the benthic VMEs became increasingly well-defined, which avoided issues associated with the implementation of complex move-on rules.[113]

75. NEAFC reported that areas where VMEs occurred or were likely to occur had been closed to bottom fishing. That included large precautionary area closures where no specific VMEs had been explicitly identified. Such closures included sub-areas within "existing bottom fishing areas" (see para. 82 below).

76. SEAFO reported that its Scientific Committee had agreed to create a set of closures constituting a biogeographically representative selection of sub-areas likely to have VMEs. Owing to limited information being available, the Committee had applied the precautionary approach. Consequently, it had focused its analyses on seamounts and seamount complexes with summit depths shallower than 2,000 metres.

77. In 2006, SEAFO first closed 11 areas to bottom fishing. Those closures were reviewed seven times within eight years, reflecting a progression of measures, as knowledge of bottom fisheries and of known or likely VMEs, increased. At present, 11 areas were closed to all gears and one area was closed to all gears except pots and longlines, following the classification of corals in some knolls in that area as VMEs.

78. SPRFMO CMM 2.03 required closing areas where VMEs were known to occur or likely to occur based on the best available scientific information, unless the SPRFMO Commission determined that such bottom fishing would not have significant adverse impacts on VMEs.[103]

(c) Developing protocols for encounters with vulnerable marine ecosystems (paragraph 119 (c) of resolution 64/72)

79. Several RFMOs have established and implemented encounter protocols, including the definition of VME indicator species and thresholds, move-on rules, including reporting procedures, and temporary closures and subsequent procedures for deciding whether or not to reopen the area.

80. CCAMLR reported that encounters with potential VMEs during the course of bottom fishing were regulated under CM 22-07, which defined "risk area", "VME indicator organism", "VME indicator unit" and encounter parameters, and specified the action required when indicator organisms were encountered. In that regard, the Scientific Committee had recommended practices and mitigation measures, including the cessation of fishing activities, if needed, when evidence of a VME was encountered. CM 22-06 included guidelines specifying categories of information to be included in notifications to the CCAMLR secretariat by Contracting Parties when a VME was encountered.

[113] Northwest Atlantic Fisheries Organization, report on the meeting of the Scientific Council, June 2013, available from http://archive.nafo.int/open/sc/2013/scs13-17.pdf.

81. To mitigate the likelihood of encounters outside of closed areas, NAFO reported that it had established thresholds for significant encounters, on the basis of scientific assessments inside the fishing footprint and on adjacent continental slopes, at 7 kg per haul for sea pens, 60 kg for other live coral and 300 kg for sponges as catch per set. Catches in excess of those amounts triggered a move-on rule, requiring a vessel to move two nautical miles before recommencing fishing operations and to inform its national administration of the encounter, which would then pass the information to the NAFO secretariat.

82. NEAFC reported that it had adopted a definition of what constituted an encounter with a possible VME, based on advice from ICES, with separate rules for trawling and longlining. It had also adopted an extensive list of VME indicator species. Where the vessel crew was not expected to have the expertise needed to identify individual species, threshold levels applied to the presence of any live coral or any live sponge. There were explicit rules on the process following such an encounter, including a temporary closure of the relevant area. For trawling, the area was a polygon of two nautical miles on either side of the track of the trawl. For other bottom-fishing gears it was an area with a radius of two nautical miles around the position that the evidence suggested was closest to the exact location of the encounter. The temporary closure applied to all Contracting Parties and remained in force until the Commission had acted on the advice from an assessment as to whether the area had, or was likely to have, a VME.

83. SEAFO indicated that CM 30/15 contained a definition of an encounter as an incidental catch of a VME indicator species above threshold levels. The identification of indicator species was to be made on a case-by-case basis through assessment by the Scientific Committee. Furthermore, the CM contained protocols on the reporting of an encounter. The Scientific Committee had compiled a provisional list of benthic invertebrate VME indicator species/groups and the Commission had adopted a coral and sponges guide to assist observers on vessels with the identification of VME indicator species.

84. Reflecting the fact that the predominant bottom fishing method is benthic longlining, CCAMLR has established thresholds based on volume, while NAFO, NEAFC and SEAFO have all established weight-based thresholds. For each of those RFMO/As, the thresholds were developed in coordination with the relevant scientific body. Both NAFO and NEAFC have re-evaluated their initial thresholds and lowered the thresholds for sponge fields and deep-sea corals. It was reported that encounters had been reported at CCAMLR, but none had been reported to date at NAFO and NEAFC. NAFO, NEAFC and SEAFO had only identified types of hard corals and sponge fields as indicator species.[105]

85. Until its Scientific Committee had developed advice, SPRFMO required its members and cooperating non-Contracting Parties engaging in bottom fishing to establish threshold levels for encounters with VMEs for vessels flying their flag, taking into account paragraph 68 of the Guidelines. It also required vessels to either apply a move-on rule throughout the footprint, whereby they needed to cease bottom-fishing activities within five nautical miles of any site where evidence of a VME was encountered above threshold levels, or to fish according to a spatial management approach, whereby the fishing footprint was divided, based on scientific advice, into areas open to bottom fishing, areas closed to bottom fishing and areas where vessels were required to cease bottom-fishing activities within five

nautical miles of any site where evidence of a VME was encountered above threshold levels. It further required encounters with VMEs to be reported to the secretariat.[114]

86. Participants in the negotiations to establish NPFC have adopted interim measures (see also paras. 51 and 125 of the present report), which include protocols for encounters with VMEs. Discussions regarding the adoption of an encounter protocol at GFCM began in 2016.

3. Measures to ensure the long-term sustainability of deep-sea fish stocks and non-target species and the rebuilding of depleted stocks (paragraph 119 (d) of resolution 64/72)

87. CCAMLR reported that it had developed conservation measures consistent with paragraph 119 (d) of resolution 64/72. In particular, it highlighted measures on monitoring, control and surveillance; the regulation of mesh size; catch and effort reporting; prohibitions on directed fishing; measures for exploratory fisheries; and precautionary catch limits.

88. NAFO reported establishing management measures for fishing opportunities in line with its precautionary approach framework, including catch and effort limitations, an effort allocation scheme for shrimp, product-labelling requirements, catch monitoring and a mandatory vessel monitoring system, a joint inspection and surveillance scheme, an observer programme, port State control measures, and a non-Contracting Party scheme, with measures to combat illegal, unreported and unregulated fishing.

89. NEAFC noted that ICES had developed an approach to providing quantitative scientific advice for data-poor fish stocks. It also reported on a number of legally binding CMMs in place, consistent with the interim guidelines on the management of deep-sea species, approved in 2014, and an interim categorization of deep-sea species, adopted in 2015. That included measures prohibiting fisheries directed at 21 deep-sea species and stipulating that the Contracting Parties should take measures to minimize by-catches of those species, measures with explicit catch limits for two deep-sea fish stocks, and general measures that limited the overall fishing effort for all deep-sea fisheries. NEAFC also had a seasonal closure to protect known spawning aggregations of one deep-sea species. It also implemented a system of monitoring, control and surveillance (see section III. A. 4 above).

90. SEAFO reported that based on the best available scientific advice, the Commission had adopted two recommendations and several conservation measures relating to the conservation and management of deep-sea fish stocks and non-target species, including, since 2011, CM 25/12 on reducing the incidental by-catch of seabirds in the SEAFO Convention Area; CM 31/15 on total allowable catches and related conditions for Patagonian toothfish, deep-sea red crab, alfonsino, orange roughy and pelagic armourhead for 2016 in the SEAFO Convention Area; and a system of observation, inspection, compliance and enforcement, which included an article on periodic reporting of catch and fishing effort by Contracting Parties (see section III. A. 4 for more information on the system).

[114] Contributions of Australia and New Zealand.

91. SPRFMO adopted CMM 2.03 in 2014 in order to, inter alia, limit bottom-fishing catch in the Convention Area to a level that does not exceed the annual average over the period from 1 January 2002 to 31 December 2006 and restrict bottom fishing to within the bottom-fishing footprint (the spatial extent and distribution of historical bottom fishing over the period from 1 January 2002 to 31 December 2006).[103] Under CMM 2.03, based on the Guidelines, scientific research and stock assessment were conducted by the SPRFMO Scientific Committee during its annual meeting to generate advice for the adoption of appropriate regulations by the Commission. The work included the development of reference points, sound fishery management strategies and rebuilding plans for declining stocks.[101]

4. Establishing mechanisms to promote and enhance compliance with applicable measures (paragraph 129 (d) of resolution 66/68)

92. CCAMLR reported on its compliance conservation measures in place, a number of which had come into force since 2011, including the marking of fishing vessels and fishing gear (2014); port inspections of fishing vessels carrying Antarctic marine living resources (2015); and automated satellite-linked vessel monitoring systems (2015). CCAMLR noted that in relation to paragraph 129 (d) of resolution 66/68, it had adopted CM 10-10, the CCAMLR compliance evaluation procedure (2015), which served as a tool to assist in monitoring the compliance of members with the decisions of the Commission.

93. GFCM has established a number of measures related to monitoring, control and surveillance, including vessel monitoring system requirements, as well as a regional scheme on port State measures to combat illegal, unreported and unregulated fishing. Through its Compliance Committee, GFCM assesses on an annual basis compliance with obligations stemming from its measures vis-à-vis Contracting Parties, cooperating non-Contracting Parties and other relevant non-Contracting Parties.[115]

94. The NAFO observer programme, outlined in article 30 of its conservation and enforcement measures, required at least one independent and impartial observer, unless certain conditions were met, including the vessel having a vessel monitoring system and an electronic observer and catch report system in place, which had been tested by NAFO and Contracting Parties. Contracting parties were required to ensure that their observers monitored compliance with the conservation and enforcement measures, including by verifying logbook entries on the composition of catch by species, quantities, live and processed weight, as well as recording gear type, mesh size, attachments, catch and effort data, coordinates, depth, time of gear on the bottom, catch composition, discards and retained undersized fish.

95. NEAFC reported that it had implemented an extensive system of monitoring, control and surveillance, as set out in its scheme of control and enforcement, which is publicly available on its website.[116] It includes monitoring of vessel access, a satellite-based vessel monitoring system, regular catch reporting, at-sea inspections and port State measures. Following indications that the Contracting Parties may not have been monitoring their vessels sufficiently in real time, the NEAFC secretariat reported that since early 2016, it had been actively monitoring the vessel monitoring

[115] GFCM response to the voluntary questionnaire.
[116] See www.neafc.org/scheme.

system in real time for activities that indicated possible bottom fishing in areas where bottom fisheries were not authorized, with a view to immediately informing the flag State and requesting it to investigate the issue further. The flag State would then be required to report on the results of such investigations.

96. SEAFO reported on its system of observation, inspection, compliance and enforcement, which addressed control measures, monitoring of fisheries, at-sea inspections, a vessel monitoring system, a scientific observer programme and port State control. It contained a section on measures to promote compliance, which included articles on sightings and identifications of non-Contracting Party vessels and listing of illegal, unreported and unregulated vessels. SEAFO has also concluded an agreement with CCAMLR, NAFO and NEAFC to jointly list such vessels.

97. SPRFMO CMM 3.03 compliance monitoring scheme set up a process to annually monitor compliance of its members and cooperating non-Contracting Parties with obligations arising under the Convention and CMMs adopted by the Commission, designed to assess compliance by members and cooperating non-Contracting Parties with their obligations under the Convention and CMMs; identify areas in which technical assistance or capacity-building might be needed to assist members and cooperating non-Contracting Parties to achieve compliance; identify aspects of CMMs, which might require improvement or amendment to facilitate or advance their implementation; and take action against non-compliance through preventive and remedial options, including possible responses taking into account the reasons for and degree of non-compliance.[101]

B. Actions taken by States to regulate bottom fisheries

98. The following section describes the wide range of measures and actions reported by States[117] to give effect to resolutions 64/72 and 66/68 to address the impacts of bottom fisheries on VMEs and the long-term sustainability of deep-sea fish stocks.

99. At a general level, several respondents stressed the importance of the relevant resolutions of the General Assembly and the Guidelines in ensuring the long-term protection of VMEs and deep-sea species from the impacts of bottom fishing on the high seas. The United States of America noted that implementation of the commitments in resolutions 61/105, 64/72 and 66/68 continued to be uneven and more work in a number of areas was necessary to fulfil the goals and objectives set forth in those instruments.

[117] Owing to the low number of responses received by the Secretariat, the present section does not purport to provide a comprehensive overview of actions taken by States. States that are members of RFMO/As may have taken additional action through such bodies and implemented the decisions of such bodies.

1. Identifying vulnerable marine ecosystems on the basis of marine scientific research and other sources of information (paragraph 119 (a) of resolution 64/72, and paragraphs 132 and 133 of resolution 66/68)

100. Australia indicated that it was cooperating on research on deep-sea species as a target species in the SPRFMO Area and was seeking to cooperate on further research relating to stock assessments in the SIOFA Area.

101. In addition to the NEREIDA programme (see para. 54 above), Canada has participated in the European Union Blue Growth Horizon to research VMEs in the north Atlantic. Canada noted that it had undertaken annual stock surveys in the NAFO Area and contributed to the stock assessments underpinning the science advice given to NAFO.

102. The European Union reported that it had brought together data from visual surveys and multidisciplinary surveys of the sea floor to identify VMEs and inform the reassessment of the NAFO bottom fisheries. It also reported on Spain's programme of scientific mapping of the seabed in areas of the high seas where its bottom fisheries take place.

103. New Zealand reported on its contribution to the identification of VMEs in the CCAMLR area through information collected on its fishing vessels, including by observers, and information from its scientific research voyages to the Antarctic, as well as to the development of models to predict the distribution of VME indicator taxa.

104. Norway reported on the systematic mapping of the Norwegian sea floor since 2006, which has facilitated the identification of VMEs and is used as a basis for decision-making on fisheries management.[110]

105. Oman reported that it did not possess a high-seas fishing fleet, and had therefore not undertaken any research programmes, but that it was working to integrate available studies and information regarding the location of marine living resources.

106. The United States reported on a number of research projects to identify VMEs, including a multi-year collaboration to discover and characterize deep-sea coral habitats in the Gulf of Mexico and a multi-year deep-water mid-Atlantic canyons project to discover and characterize the sea floor communities that live in association with east coast submarine canyons. From 2009 through 2015, the United States had conducted three-year deep-sea research initiatives focused on mapping, modelling and understanding the ecological functions of deep-sea coral and sponge ecosystems, which included cooperative surveys with Canada for VMEs in both the Pacific and Atlantic Oceans. It had also recently begun a three-year deep-sea research and exploration effort to increase the understanding of VMEs in the north and south Pacific. It had developed a new deep-sea coral and sponge database, and collaborated with New Zealand to identify VMEs in the south Pacific.

2. Adopting conservation and management measures to protect vulnerable marine ecosystems or closing areas to bottom fishing until such measures are in place (paragraph 132 of resolution 66/68)

107. Several respondents reported on a wide range of measures to regulate bottom-fishing vessels or close areas to bottom fishing, including through issuance of

fishing permits, limits on the use of fishing gear, area-based management tools and monitoring, control and surveillance mechanisms.

108. As part of its commitment to relevant interim measures, Australia noted that it had prepared an impact assessment for its bottom-fishing activities in the SPRFMO and SIOFA Areas, which took into account the individual, collective and cumulative impacts of fishing on VMEs and had been made publicly available. The assessments indicated that the risk of significant adverse impacts on VMEs from Australian vessels was low for demersal trawl and demersal auto-longline and negligible for mid-water trawl and drop-line. Australia reported that it might review its bottom-fishing impact assessments if new information became available, or if fishing activity changed. It also reported on recent research within areas of national jurisdiction on the assessment of the vulnerability of benthic habitats to impacts by demersal gears that could be applied in areas beyond national jurisdiction in considering the impacts of bottom fishing.

109. Canada reported that all high-seas fishing by its vessels and activities occurring in the waters of another State were subject to domestic licensing requirements, which required compliance with Canadian laws in all areas of the high seas, including areas where no RFMO existed. It applied an ecological risk assessment framework to help identify the level of ecological risk of fishing activity and its impacts on sensitive benthic areas in the marine environment, in particular cold-water corals and sponges. Scientific assessments and research were peer reviewed and made publicly available.

110. The European Union indicated that its member States could only issue special fishing permits for the use of bottom-fishing gears on the high seas if specific conditions were met, including those regarding prior impact assessments, unforeseen encounters with VMEs, area closures and an observer scheme. The use of bottom-fishing gears was prohibited in areas where no proper scientific assessment had been carried out and made available. The protection of sensitive and vulnerable habitats in areas beyond national jurisdiction was also promoted by the establishment of fishing protected areas.

111. The European Union had established a specific access regime for fishing vessels engaged in the deep-sea fisheries of the north-east Atlantic, consisting of four main components: capacity restriction, data collection, effort monitoring and control. A proposal to update the regulation was currently being considered, which would represent a shift towards selective, science-based fishing for deep-sea species, incorporating the precautionary approach and ensuring minimal impact of fishing gears on vulnerable deep-sea ecosystems. The European Union also reported on a range of measures for managing deep-sea fisheries, including under its Common Fisheries Policy, such as restrictive fishing permits, reporting obligations and requirements for satellite tracking devices and scientific observers.

112. The European Union noted that, in application of its regulations, Spain had restricted fishing in the south-west Atlantic to the area defined by the historical footprint of the fishery. Spain had closed off nine areas with a total extent of 41,000 km^2 to bottom fishing by its fleet.

113. Iceland reported that vessels fishing outside areas of national jurisdiction were subject to its national legal regime aimed at fulfilling general obligations to protect living marine resources.

114. New Zealand noted its qualitative risk and impact assessment for its bottom trawl and bottom longline fishing operations in the SPRFMO Convention Area, as required by the relevant interim measures for bottom fisheries, which had been reviewed by the SPRFMO Scientific Working Group. The assessment was used as the basis for the development of a management approach for New Zealand bottom trawling operations in the SPRFMO Area.

115. In 2011, Norway adopted a regulation on bottom fishing in its exclusive economic zone, which addresses the requirements of General Assembly resolution 61/105 by, inter alia, establishing a footprint at depths above 1,000 metres. It also adopted legislation to protect cold water coral reefs, under which 18 reefs have been given special protection. Since 1999, a general duty of care has been in place for Norwegian flagged vessels during fishing operations near known coral reefs, both in areas under Norwegian fisheries jurisdiction and all other areas.

116. In addition to gear restrictions, Oman reported that its fishermen were required to declare equipment lost during fishing activities and to place markings on equipment during use, and that it had prohibited the use of monofilament fishing nets on the whole fishing fleet.

117. The Philippines had ensured effective control over its distant-water fishing fleets by requiring strict compliance with the terms of fishing permits and by monitoring, control and surveillance mechanisms, such as observer coverage.

118. The United States reported that none of its vessels were authorized to conduct bottom fisheries in areas beyond national jurisdiction outside RFMOs. Authorization to conduct bottom fishing on the high seas outside RFMOs would only be granted upon completion of an assessment of impacts on the environment, including on VMEs. The United States was working to improve the monitoring of its fishing vessels on the high seas, including through adjustments to permitting and reporting procedures, requirements for installation and operation of enhanced mobile transceiver units for vessel monitoring, observer coverage, reporting of trans-shipments taking place on the high seas and protection of VMEs.

119. A number of respondents also reported on actions taken to prevent significant adverse impacts on VMEs within areas of national jurisdiction. Canada reported on a number of fishery closures to protect corals and/or sponges from fishery-related impacts. Iraq indicated that its fishing vessels did not use bottom-trawl gear within the territorial sea. Oman prohibited all bottom fishing in its maritime zones in 2011. Chile reported that it had prohibited all bottom-fishing activities on all seamounts lying in its maritime zones which are indicative of VMEs, in an area of 68,065 km^2.

3. Measures to ensure the long-term sustainability of deep-sea fish stocks and non-target species, and the rebuilding of depleted stocks (paragraph 119 (d) of resolution 64/72)

120. Several respondents reported on efforts to ensure the long-term sustainability of deep-sea fish stocks and non-target species and the rebuilding of depleted stock, including scientific research programmes, including in the context of their work through RFMO/As (see section III. A. 3 above).

121. Canada reported on guidelines for the development of rebuilding plans for severely depleted fish stocks to ensure that such plans were developed in a nationally coherent manner, consistent with the precautionary approach. New

Zealand indicated that it was using a predictive habitat model to develop estimates of potential orange roughy biomass in the SPRFMO area, as a basis for making recommendations on orange roughy catches likely to be sustainable.

122. The European Union reported on measures which provided for the fixing and allocation of fishing opportunities, prohibition of discards and landing obligations, establishment of protected areas and collection of scientific data. It also noted its general legislative frameworks for the protection of VMEs and marine biodiversity; policies to reduce the impact of economic activities on the marine environment; participation in regional seas conventions that provided for international cooperation on marine ecosystem protection; and financial support and investment in measures that contributed to the protection of VMEs and to restoring marine biodiversity and ecosystems.

4. Establishing new regional fisheries management organizations or arrangements and prohibiting bottom-fishing activities where no regional fisheries management organization or arrangement exists (paragraphs 120 and 124 of resolution 64/72)

123. Since the report of the Secretary-General to the General Assembly in 2011 (A/66/307), three new RFMO/As have been established, namely SIOFA and SPRFMO in 2012 and NPFC in 2015 (see paras. 48-51 above). In addition, the Declaration Concerning the Prevention of Unregulated High Seas Fishing in the Central Arctic Ocean was signed by all five Arctic Ocean coastal States in 2015. It expresses an intention to implement certain interim measures, acknowledges the interest of other States in preventing unregulated high-seas fisheries and envisions a broader process to develop measures that would include commitments by all interested States. Canada reported that the relevant coastal States were working to develop measures consistent with the Declaration.

124. Australia reported that, since SIOFA had not established binding CMMs, it managed fishing vessels operating in the SIOFA Regulatory Area consistent with the Guidelines and under conditions similar to those applicable to vessels operating in the SPRFMO Area. It was working with SIOFA parties towards a spatial management approach. Australia monitored the total catch taken from bottom fishing in the SIOFA Regulatory Area against the average annual catch level between 1999 and 2009.

125. The United States noted that participants in the negotiations of NPFC had developed interim measures, including those applicable to the north-eastern Pacific Ocean in 2011, for use in the identification and assessment of marine species and VMEs and a protocol for exploratory fisheries, and were beginning to cooperate to ensure the long-term and sustainable use of fisheries in the convention area.

126. Several States reported that their vessels were not authorized to conduct bottom fisheries in areas beyond national jurisdiction or did not fish outside areas regulated by RFMO/As (Bulgaria, Canada, Iraq, New Zealand, Philippines, Oman and United States). Bulgaria reported that fishing vessels in its register were not engaged in deep-sea fisheries in areas beyond national jurisdiction, Canada noted that fishing by its vessels in areas beyond national jurisdiction occurred almost exclusively in the convention areas of RFMO/As. Oman indicated that any future authorization to conduct bottom fishing in areas beyond national jurisdiction would be granted in accordance with the Guidelines. Iraq reported that it had no ships

fishing on the high seas. The Philippines noted that its vessels were not currently engaged in bottom fishing on the high seas.

5. Implementing measures adopted by regional fisheries management organizations or arrangements

127. Several States reported on their actions to support the adoption and implementation of CMMs in RFMO/As to which they belonged, to regulate bottom fishing and protect VMEs from the impact of bottom-fishing activities, pursuant to relevant resolutions of the General Assembly (Australia, Canada, European Union, Iceland, New Zealand, Norway, Philippines and United States). A number of States reported on actions taken at the national level to implement CMMs adopted in RFMO/As to address the impacts of bottom fishing on VMEs, including through encounter protocols (Australia and New Zealand), licensing systems (Australia, Canada, Iceland, New Zealand and Philippines), catch limits (New Zealand), monitoring, control and surveillance mechanisms (Canada and New Zealand) and impact assessments (Australia, New Zealand and Oman).

128. Some States have also adopted monitoring, control and surveillance measures. New Zealand noted that it had undertaken pre- and post-trip inspections of vessels heading into the CCAMLR area and aerial and surface patrolling and had reported all sightings of illegal activities to the CCAMLR secretariat. The Philippines had integrated into its newly amended fisheries code a penal provision for violation of CMMs enacted by the RFMO/As or through international or regional agreements relative to fishing in high seas convention areas.

C. Actions taken by States and competent regional fisheries management organizations and arrangements in cooperating to undertake marine scientific research, collect and exchange scientific and technical data and information and develop or strengthen data-collection standards, procedures and protocols and research programmes

1. Exchanging best practices and developing regional standards (paragraph 122 (a) of resolution 64/72)

129. The European Union reported that its member States provided their respective survey data to ICES. In that regard, data as well as best practices were made available to the RFMOs to which the European Union was a party.

130. NEAFC reported that ICES conducted extensive work relating to developing scientific best practices and standards.

131. NAFO noted that it participated in regular exchanges and international forums, mediated through FAO or bilaterally with other RFMOs, to develop and implement best practices.

132. SEAFO reported on its active role in promoting and setting standards, as well as enhancing the exchange of best practices, by participating in various forums. For instance, SEAFO co-authored a chapter of a publication by FAO to review best practices by an RFMO in deep fisheries.

2. Making assessments and adopted measures publicly available (paragraph 122 (b) of resolution 64/72, and paragraph 130 of resolution 66/68)

133. Generally, RFMOs with the competence to regulate bottom fisheries reported that they maintained websites that detailed and publicized conservation measures that had been adopted by their Contracting Parties.

134. In addition, several States reported on the publication of assessments or measures by RFMOs. Examples were provided by Australia and New Zealand. Australia noted that an impact assessment for its bottom-fishing activities in the SPRFMO and SIOFA Areas prepared in 2011 had been made publicly available (see para. 108 above). New Zealand indicated that SPRFMO and CCAMLR impact assessments were publicly available on their respective websites.

135. NAFO reported that all assessments of the extent of VMEs in its Regulatory Area and the assessments of any impacts of fishing activity on them were publicly available on its website and in the FAO VME database. While details of exploratory fishery activities were considered confidential, summaries of the discussion on the impacts of such activities could also be found in NAFO Scientific Council reports.

136. NEAFC reported that information made publicly available on its website included reports on all of its meetings, including those where assessments were acted on, and various legally binding CMMs relating to deep-sea species and the protection of VMEs.

137. SEAFO reported that the impact assessments provided by Contracting Parties were evaluated by its Scientific Committee and published in the annual SEAFO Scientific reports, together with assessments conducted by SEAFO scientists, and made available on the SEAFO web page. Catch data was also submitted to FAO annually.

3. Submission by flag States of lists of authorized vessels and relevant adopted measures to FAO (paragraph 122 (c) of resolution 64/72)

138. Australia reported that it had provided all data required by RFMO/As to which it was a party and had also provided data to FAO when requested. New Zealand indicated that it had provided a list to FAO of its flagged vessels that had approval to fish on the high seas using bottom-fishing methods.

139. The United States reported that, as vessels flying its flag were not authorized to conduct bottom fisheries in areas beyond national jurisdiction outside of RFMOs, it did not maintain a list of such vessels.

4. Sharing information on vessels engaged in bottom fishing where the flag State responsible cannot be determined (paragraph 122 (d) of resolution 64/72)

140. NEAFC reported that any vessel identified as engaging in or supporting fishing activities in the NEAFC area that was not flying the flag of a Contracting Party was placed on the list of suspected illegal, unreported and unregulated vessels ("A" list) and if the vessel was confirmed as having engaged in or supported illegal, unreported and unregulated fisheries, it was placed on the list of confirmed illegal, unreported and unregulated vessels ("B" list), which was shared with other RFMOs and made publicly available on the NEAFC website. NAFO reported that it maintained a list of vessels linked to illegal, unreported and unregulated fishing on

its website and exchanged details of them with other RFMOs (for additional information on mechanisms to enhance and promote compliance with applicable measures, see section III A 4).

5. Developing or strengthening of data collection standards, procedures and protocols and research programmes (paragraph 123 of resolution 64/72)

141. In addition to the publication of its guide (see para. 57 above), NAFO indicated that it had adopted measures requiring all catches of VME indicator species to be recorded at the lowest taxonomic level possible by observers and that to facilitate this, the secretariat had forwarded to FAO a list of VME indicator species, which currently lacked aquatic sciences and fisheries information system (ASFIS) codes, for inclusion in the 2016 FAO species list.

142. NEAFC reported that its comprehensive recommendation on the protection of VMEs included annexes on a VME data collection protocol, an assessment of exploratory bottom-fishing activities and on VME indicator species.

143. SEAFO reported that its Commission had adopted data collection protocols, developed by its Scientific Committee, which ensured that a representative part of all catches were sampled. Its marine research guidelines, available on the SEAFO web page, were developed to ensure that high-quality science could be conducted freely and to the benefit of all, in a manner which did not cause significant adverse impacts on marine ecosystems and organisms, including fisheries resources.

D. Recognition of the special circumstances and requirements of developing States[118]

144. The special requirements of developing States were recognized in the constitutive instruments of several RFMO/As, including SEAFO, GFCM, SPRFMO and SIOFA. Some States and RFMO/As reported that they had recognized the special circumstances and requirements of developing States by engaging in capacity-building and assisting them.

145. The United States reported that its National Oceanic and Atmospheric Administration was a partner in the programme on global sustainable fisheries management and biodiversity conservation in the areas beyond national jurisdiction of the Global Environment Facility which, inter alia, provided assistance to developing countries to implement the Guidelines. It had also developed a field sampling guide on corals in English, Korean and Japanese that could be used by scientific observers operating over the Emperor Seamounts. New Zealand had assisted Pacific small island developing States by supporting the sustainable management of offshore fisheries, with focused areas of cooperation, including fisheries management frameworks at the national, regional and subregional levels, and the implementation of successful fisheries surveillance and enforcement regimes.

146. In 2009, CCAMLR emphasized the importance of fair burden sharing, having better data sharing, enhancing participation in working groups, exchanging scientists and relevant documentation. It has established a Scientific Committee

[118] See General Assembly resolutions 64/72, para. 121, and 66/68, para. 134.

scholarship, using funds donated by Norway.[119] SPRFMO maintains a budget for developing States to attend its meetings.[120]

147. The NAFO development internship programme has provided training for citizens of developing States.[121]

148. NEAFC has engaged in projects focused on working with developing States and capacity-building. SEAFO established a Special Requirements Fund in 2009 to financially support initiatives in developing States. It also sponsored two observer training workshops and several capacity-building opportunities arose during the research cruise of the *RV Dr. Fridtjof Nansen* referred to in paragraph 59 above.

IV. Activities of the Food and Agriculture Organization of the United Nations to promote the regulation of bottom fisheries and the protection of vulnerable marine ecosystems

149. FAO reported on a number of actions taken to assist the implementation of the relevant provisions of General Assembly resolutions 64/72 and 66/68, including paragraphs 135 and 136 of resolution 66/68.

150. FAO continued its work to assist in the implementation of the Guidelines. Its deep-sea fisheries programme was implemented through targeted contributions and through projects supported by various donors.[122] In 2014, a project on sustainable fisheries management and biodiversity conservation of deep-sea ecosystems in the areas beyond national jurisdiction was launched to contribute to strengthening international policy and legal frameworks; supporting planning and management in deep-sea fisheries; and reducing impacts on VMEs. FAO is also a partner in SponGES, a project on "Deep-sea sponge grounds ecosystems of the North Atlantic: an integrated approach towards their preservation and sustainable exploitation".

151. With regard to the research cruise of the *R/V Dr Fridtjof Nansen* in 2015 in the Convention Area of SEAFO, follow-up activities include capacity-development activities for further analysis of the reference collection and publication of the results. FAO also conducted a trans-Indian Ocean survey from Indonesia to South Africa. It organized and/or supported a series of four regional multi-stakeholder workshops to facilitate information-sharing and discussions on issues related to VMEs. In the Caribbean, the workshop led to the identification of VMEs by the Western Central Atlantic Fishery Commission. One additional regional workshop (for the central eastern Atlantic) is planned for 2016. In addition, a multi-stakeholder workshop was held in May 2015 in collaboration with the Norwegian Institute of Marine Research to facilitate the sharing of best practices and effective solutions on VME encounter protocols and impact assessments.

[119] See www.ccamlr.org/en/publications/special-requirements-developing-states.

[120] See www.sprfmo.int/assets/Meetings/Meetings-2013-plus/Commission-Meetings/4th-Commission-Meeting-2016-Valdivia-Chile/FAC-03-07-Budget-categories-for-the-Scientific-Committee-and developing-states.pdf.

[121] See Northwest Atlantic Fisheries Organization, *NAFO Performance Assessment Review 2011*, 5 August 2011, available from www.nafo.int/publications/PAR-2011.pdf.

[122] See www.fao.org/fishery/topic/16160/en.

152. Regional training workshops on the identification of deep-sea cartilaginous fishes of the Indian Ocean and the southern Atlantic Ocean were held in 2014 and 2015, respectively, to improve the capabilities of scientists from the region in the identification of those species. After consultations with relevant stakeholders, FAO finalized species guides and catalogues of the deep-sea cartilaginous fishes of the Indian Ocean and the south-eastern Atlantic for use on board vessels by observers, scientists and non-scientific personnel. The development of similar tools has been initiated for the south-eastern Pacific region and will be finalized in 2016.

153. A manual on the collection of biological data on deep-sea species is to be published in 2016. In addition, an electronic application (SmartForms) for reporting on-board observations related to VMEs and biodiversity reporting from deep-sea fisheries vessels is currently being developed by FAO and an interested group of RFMOs.

154. Work has been initiated to update and expand the *Worldwide Review of Bottom Fisheries in the High Seas* (FAO, 2009) by addressing information gaps identified in the last review, describing progress made on the monitoring of data-poor deep-sea stocks and benefiting from updated stock assessments for key species. A global review of alfonsino fisheries, biology and management is available[74] and a similar review of the biology and assessment of orange roughy is under way. FAO is also working to analyse existing policy and legal frameworks for addressing biodiversity in sustainable fisheries in the project on sustainable fisheries management and biodiversity conservation of deep-sea ecosystems in the areas beyond national jurisdiction and develop practical tools to improve their implementation. The information reported to FAO in relation to General Assembly resolution 61/105 was made publicly available through the FAO website. Capacity development has been incorporated at various levels in FAO activities supporting implementation of the Guidelines. That includes the use of species identification tools, on-the-job training during research surveys and training on analysing research information, as well as capacity development in relation to all elements of the Guidelines.

155. The VME portal and database was launched in December 2014 to establish a global database of information on vulnerable marine ecosystems in areas beyond national jurisdiction. It serves as an information sharing-platform as well as an awareness-building tool to promote the transparency and accessibility of work that has been done in relation to VMEs to the general public. Furthermore, FAO reported that a review entitled "Vulnerable marine ecosystems: processes and practices in the high seas" was close to being finalized. The main chapters described actions taken in regions covered by RFMO/As and regions where there were no regional management bodies. Domestic measures applied by States to their flagged high-seas fishing vessels were only included when particularly relevant, such as in areas where there were no current regional measures from a regional body.

V. Concluding remarks

156. In the past five years, steady progress has been made in understanding, inter alia, the characteristics of different types of possible VMEs and the diverse impacts of different bottom-fishing gears, as well as the characteristics and status of some deep-sea fish stocks, although the overall state of knowledge remains limited. To address the issue of insufficient data, new methods are being developed for stock

assessments of deep-sea fish where data is poor, or is only available from fish catches. In the absence of observational data on the presence of VMEs, habitat suitability modelling is being used as a guide to VMEs and can now be used in analysing the risk of encounters of bottom fisheries with VMEs. While bottom trawls have had the greatest impact, bottom longlining is increasingly recognized as capable of damaging VMEs, among other bottom-fishing gears. Technical modifications of fishing gear or changes in fishing practices have been implemented as a way to reduce impacts, but with limited success.

157. Significant progress has been made in terms of the establishment of new RFMO/As since 2011. Based on the responses received from RFMO/As and several States, there has also been good progress in the identification of VME indicator species by a number of RFMO/As and States, through the conduct of research programmes and/or the elaboration of the definition of VMEs in the context of their regions. In some RFMO/As, where progress has been limited, individual members have undertaken work to identify VME indicator species and/or their distribution.

158. RFMO/As have adopted a number of CMMs relating to VME protection, including regarding the conduct of bottom fisheries if they are assessed as not having significant adverse impacts on VMEs; the submission of preliminary assessments of impacts; and mitigation measures. However, information on the conduct of assessments in relation to cumulative impacts appears limited, except in some RFMO/As. In addition, the requirement of impact assessments in some RFMO/As appears to provide insufficient protection within the existing fishing footprints. Flag States have adopted measures to regulate bottom fishing by vessels flying their flag, including for areas where there is no RFMO/A competent to regulate bottom fisheries. Such measures range from the prohibition of fishing to the granting of licences after impact assessments have been carried out.

159. Several RFMO/As have closed areas where VMEs occur, or are likely to occur. In areas where there is no RFMO/A, some States have closed certain areas with VMEs to bottom fisheries by vessels flying their flag. Some RFMO/As have reviewed and updated such closures in light of new information regarding VMEs and deep-sea fish stocks. Other RFMO/As could consider similar actions.

160. Several RFMO/As have established and implemented encounter protocols, including thresholds levels for VME indicator species, move-on rules and temporary or permanent closures. While conservative threshold values established by some RFMO/As would enable the full implementation of the relevant paragraphs of General Assembly resolutions 64/72 and 66/68, thresholds set by other RFMO/As are too high to provide effective protection for VMEs. In addition, the requirement of "live" by-catch species by some RFMO/As may prevent them from taking timely action based on the identification of VMEs. Some RFMO/As have only identified types of hard corals and sponge fields as indicator species. Members of some RFMO/As have yet to agree on thresholds for encounter protocols. Furthermore, difficulties associated with the implementation of encounter protocols, including move-on rules, remain. All in all, whether or not existing encounter protocols, including threshold levels, are providing sufficient protection for VMEs should be further investigated.

161. A number of RFMO/As have adopted CMMs to ensure the long-term sustainability of deep-sea fish stocks, including catch and effort reporting, gear restrictions, measures for exploratory fisheries, precautionary catch limits and

prohibitions on directed fishing. Some RFMO/As have yet to adopt a full range of measures, for example setting catch/effort limits.

162. In addition to the measures outlined above, a number of other actions addressing other parts of the relevant resolutions have been adopted by RFMO/As and States, including cooperation to undertake marine scientific research; the collection and exchange of scientific and technical data and information, and development or strengthening of data-collection standards, procedures and protocols and research programmes; and capacity-building activities for developing States. In regard to the last issue, a limited number of States reported on their capacity-building activities for managing bottom fisheries specifically. Developing States will need effective assistance in that regard.

163. Overall, while a number of actions have been taken, implementation of resolutions 64/72 and 66/68 on a global scale continues to be uneven and further efforts are needed. Unless timely actions are taken by all the stakeholders concerned, overfishing of deep-sea species is likely to continue and some VMEs will not be adequately protected from significant adverse impacts. If fully implemented, however, resolutions 64/72 and 66/68 and the Guidelines continue to provide a good basis for protecting VMEs from significant adverse impacts resulting from bottom fishing and ensuring the long-term sustainability of deep-sea fish stocks.